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**Cleaning and degreasing apparatus**

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## ABSTRACT

Cleaning apparatus 10 for automatically washing and degreasing mechanical parts, such as industrial automotive parts, using a cleaning fluid comprises a top-loading washing chamber 50, a sprayer 110 for spraying cleaning fluid over the parts, a pumping device 100 for pumping cleaning fluid into the sprayer, and a collection tank 90 for collecting cleaning fluid which drains off the parts. The collection tank forms a base of the apparatus beneath the washing chamber, and the apparatus is arranged to recirculate cleaning fluid by pumping at least some of the cleaning fluid collected in the tank back to the sprayer. The tank is arranged such that a portion 140 of the collection volume protrudes from beneath the washing chamber and at least some of the protruding portion is disposed vertically below the pumping device. The present invention allows the access height of the washing chamber to be kept to a minimum.

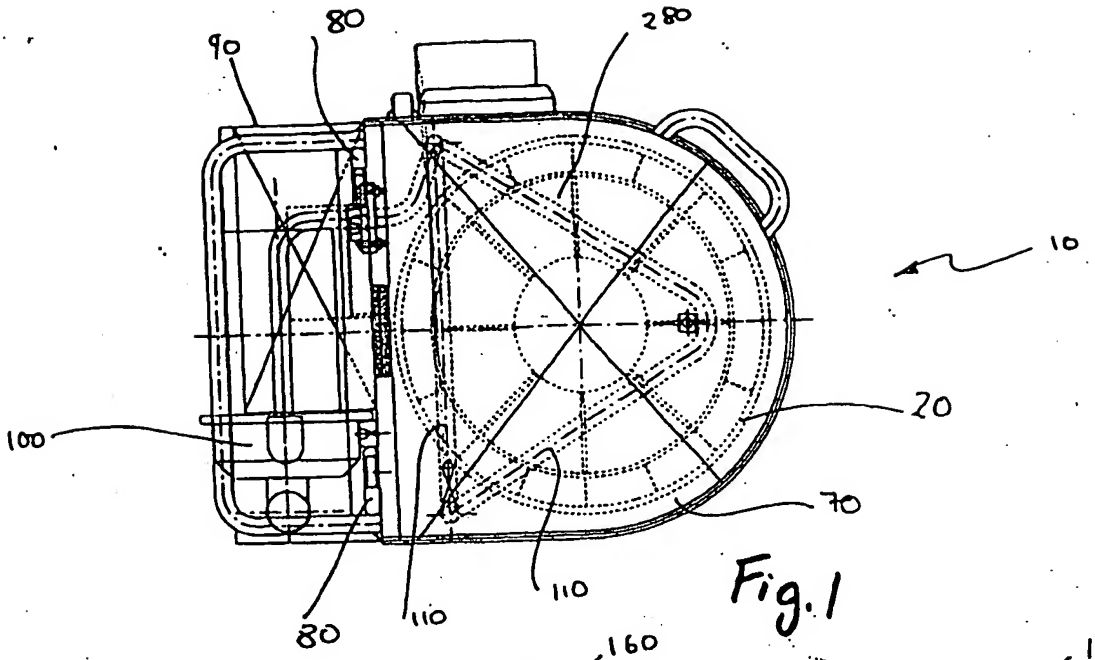
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Fig. 1

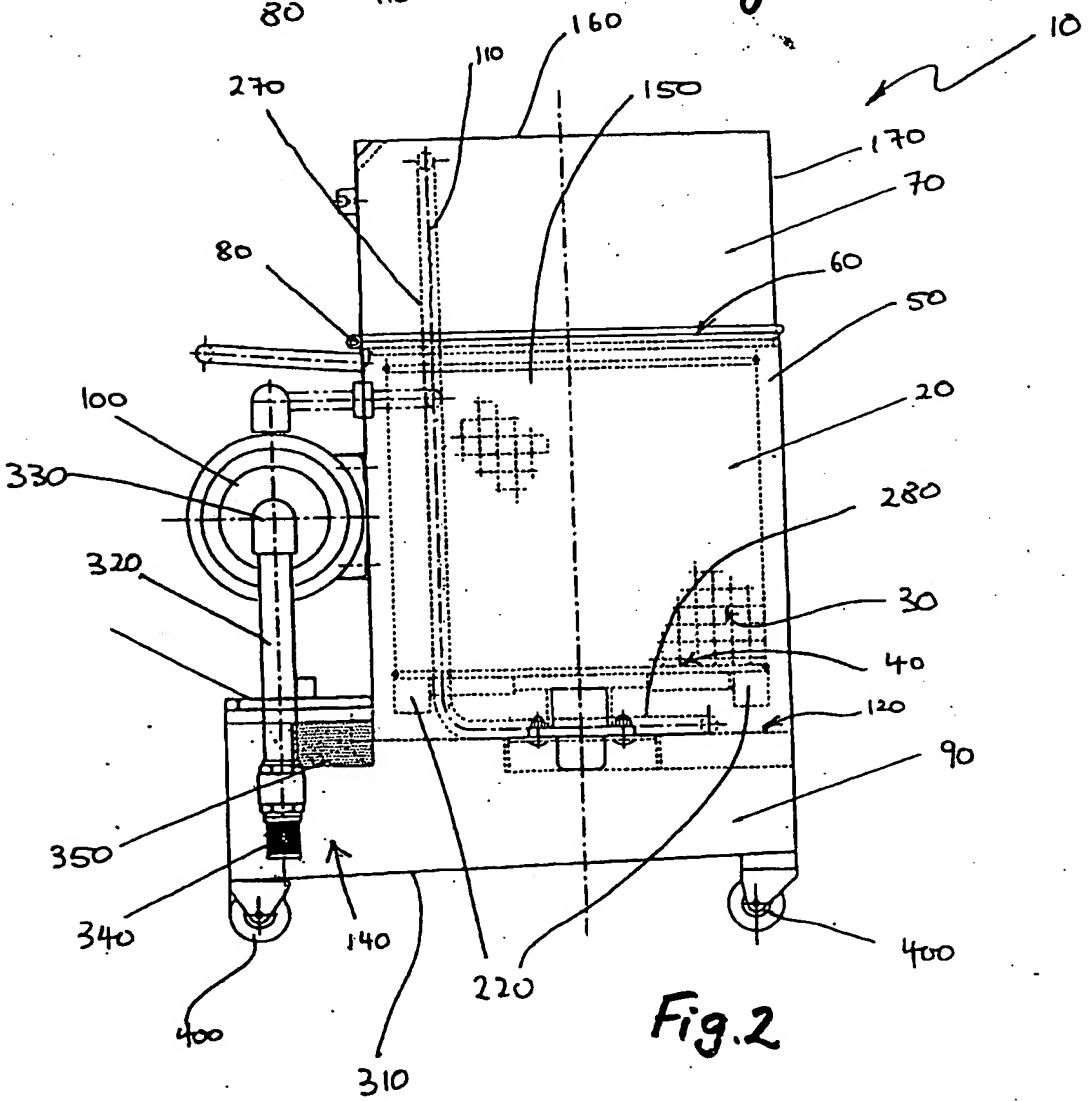
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Fig. 2

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**COMPLETE SPECIFICATION**

**STANDARD PATENT**

**Applicant(s):**

ERS AUSTRALIA PTY LTD

**Invention Title:**

A CLEANING APPARATUS

The following statement is a full description of this invention, including the best method of performing it known to me/us:

# A Cleaning Apparatus

## Technical Field

The present invention relates generally to an apparatus for cleaning and degreasing parts, and in particular industrial mechanical parts such as automotive components and the like.

## Background of the Invention

During the repair or manufacture of industrial mechanical apparatus it is often necessary to clean grease and oil from components. For example, car mechanics are often faced with the problem of cleaning automotive parts which are heavily contaminated with petroleum-based lubricants. Cleaning apparatus are known which have the capacity to automatically wash and degrease such parts on a large scale using steam and/or and an aqueous solution containing a detergent. An example of this type of apparatus has a wide rotating horizontal basket which holds the parts whilst they are sprayed with a spray head. The cleaning solution which drains off the parts is continuously collected in a collection tank and pumped back to the cleaning head. However, such an apparatus is not suitable for small-scale operations where there are only a small number of parts to be washed, and floor space is restricted.

It is to be understood that, if any prior art publication is referred to herein, such reference does not constitute an admission that the publication forms a part of the common general knowledge in the art, in Australia or in any other country.

Summary of the Invention

The present invention provides a cleaning apparatus for automatically washing and degreasing mechanical parts, including industrial automotive parts, using a cleaning fluid, the apparatus comprising a top-loading washing chamber, a sprayer for spraying cleaning fluid over the parts, a pumping device for pumping cleaning fluid into the sprayer, and a collection tank for collecting cleaning fluid which drains off the parts, the collection tank forming a base of the apparatus beneath the washing chamber, and the apparatus being arranged to recirculate cleaning fluid by pumping at least some of the cleaning fluid collected in the tank back to the sprayer, wherein the tank is arranged such that a portion of the collection volume protrudes from beneath the washing chamber and at least some of the protruding portion is disposed vertically below the pumping device.

In comparable apparatus of the prior art, the pumping device is disposed beside rather than above the collection tank. This configuration has the disadvantage that if the footprint of the apparatus (i.e. the floor area occupied by the apparatus) is reduced, the height of the apparatus must be increased because the height of the collection tank must be increased in order to maintain the same collection volume. This makes it inconvenient for users to access the top-loading washing chamber. The present invention has the advantage that it allows the footprint of the apparatus to be reduced while keeping the access height of the washing chamber to a minimum because at least a portion of the collection volume is distributed beneath the pumping device.

At least some embodiments of the present invention may provide an automatic apparatus having a footprint

which is comparable to that of known small-scale manual solvent-based cleaning apparatus. The cleaning fluid is preferably an aqueous cleaning solution. The present invention therefore makes it possible to employ a small-footprint aqueous cleaning apparatus in small-scale operations. Solvent-based cleaning is generally undesirable as the disposal of contaminated solvents can be expensive, and vapours of the solvents can pose a health hazard if inhaled in sufficient quantities.

The apparatus preferably also comprises a holder for holding the parts in the washing chamber during cleaning. The holder is preferably arranged such that elongate parts are held in a substantially-vertical orientation during cleaning. Such a holder allows the footprint of the apparatus to be kept to a minimum. The holder may be formed from a base and side walls, both having perforations which allow the cleaning solution to enter into or drain from the holder. The height of the side walls may be similar to the diameter of the base, thereby allowing parts to be held vertically.

The holder may comprise a basket, and walls of the basket may be formed from a wire mesh. The wire mesh is preferably coarse in order to allow the cleaning solution to readily enter or leave the basket, but small enough to prevent parts from passing through the mesh. The holder may include one or more vertical dividing walls arranged such that a plurality of compartments are formed in which parts can be held with a vertical orientation. The dividing walls may be removable from the side walls and the base of the holder.

In one embodiment, the holder comprises a basket with vertically-oriented cylindrical wire mesh side walls, and a wire mesh base. The ratio of the height of the side

walls to the diameter of the base is 0.74. The parts are inserted into the holder from an opening in an upper end of the holder. The holder is arranged to hold parts vertically with removable radially-oriented spokes.

The holder may be arranged to rotate around a central vertical axis. Rotation of the holding means may be driven by a separate motor. Preferably, however, rotation of the holder is driven by a flow of cleaning fluid from the sprayer. The sprayer may be arranged to form a jet of cleaning fluid which impinges on the holder in such a way that the holder is forced to rotate. The holder may have at least one generally-planar surface, such as a rotor blade, for intercepting the jet of cleaning fluid such that the holder is forced to rotate.

The cleaning apparatus preferably includes a lid which forms a water-tight seal against the washing chamber when shut. In order to accommodate particularly long parts in the washing chamber, the lid may include walls which depend downwardly from an upper surface of the lid. The walls of the lid raise the height of the upper surface of the lid, and thereby vertically extend the internal volume of the washing chamber.

Where the cleaning fluid comprises an aqueous solution, the apparatus may be arranged to heat the solution in order to optimise the washing efficiency. Preferably, the solution is heated to a temperature of 68 °C. A temperature sensor and fluid heater may be provided in the collection tank to monitor the fluid temperature and to heat it when the temperature falls below 68 °C. The aqueous solution may have a pH in the range from 11 to 11.5. The aqueous solution may be formed by combining water with a caustic powder, such as a surfactant with a sodium metasilicate base. Preferably, the aqueous

solution is sprayed from the sprayer at high pressure. In a preferred embodiment, the aqueous solution has an average temperature of 68 °C, a pH in the range from 11 to 11.5, and is sprayed from the sprayer at a pressure of 45 PSI. This embodiment cleans the parts with a three-way action, namely using heat, high alkalinity, and high pressure.

The pumping device may be powered by a single phase electric motor. This avoids the need for a three phase power supply. However, it limits the maximum power of the pumping device that can be used in the apparatus. The pumping device may pump cleaning fluid from the collection tank via an in-line filter in order to reduce the amount of particulate matter which is recirculated. The in-line filter may comprise a perforated cap at the end of a suction tube. The cap may be formed of metal and the perforations may have a diameter of approximately 100 μm.

The sprayer is preferably arranged to simultaneously spray a plurality of different areas of the holder. The sprayer may be arranged to form at least one jet of spray oriented in at least one respective direction. The sprayer may include a plurality of apertures arranged at a plurality of different vertical heights to direct cleaning solution towards the holder in a generally-horizontal plane. The sprayer may also include at least one aperture arranged to form a jet of spray oriented in a non-horizontal direction.

The apparatus is preferably arranged to automatically pass through a number of different cleaning stages, including cleaning and rinsing. The apparatus may include at least one predetermined automatic cleaning cycle. Each cycle may vary in the duration of the cleaning stage,

duration of the rinsing stage, and cleaning solution temperature.

The apparatus may be portable, and may include wheels such as castor wheels to enable the apparatus to be moved. The wheels may be lockable to prevent rolling. The apparatus may have a manual cleaning mode in which cleaning fluid is diverted from the sprayer to a hand-operated cleaning nozzle.

Throughout this specification, unless the context requires otherwise, the word "comprise" or variations such as "comprises" or "comprising", will be understood to imply the inclusion of a stated element or integer or group of elements or integers but not the exclusion of any other element or integer or group of elements or integers.

Brief Description of the Drawings

An embodiment of the present invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Fig 1 is a top view of an embodiment of a cleaning apparatus according to the present invention.

Fig 2 is a side view of the cleaning apparatus shown in Fig 1.

Fig 3 is an end view of the cleaning apparatus shown in Figs 1 and 2.

Fig 4 is a side view of a holding basket used in the cleaning apparatus shown in Figs 1-3.

Fig 5 is a bottom view of the holding basket shown in Fig 4.

Fig 6 is an isometric view of a spray manifold used in the cleaning apparatus shown in Figs 1-3.

Detailed Description of the Drawings

An embodiment of an automatic cleaning apparatus will now be described with reference to Figs 1 to 6. The cleaning apparatus 10 is particularly suited to washing and degreasing industrial mechanical parts, such as automotive parts, contaminated with grease and/or oil, but is not limited to such applications. The apparatus is designed to wash such parts with an aqueous cleaning solution. Parts to be cleaned are contained within a basket 20 having cylindrical wire mesh side walls 30 and a wire mesh base 40. The basket 20 is mounted vertically in a washing chamber 50 with an access opening 60 designed to be sealed closed with a lid 70 arranged to pivot at side hinges 80. Cleaning solution is stored in a collection tank 90 which forms a base of the apparatus 10. The apparatus 10 operates by pumping the cleaning solution with a pump 100 into a spray head comprising a spray manifold 110, and spraying the cleaning solution at high pressure (45 PSI) over parts within the basket 20. Cleaning solution which has been sprayed over the parts drains to the bottom 120 of the washing chamber 50 and into the tank 90, where it is drawn back by the pump 100 and re-sprayed through the spray manifold 110.

The tank 90 is shaped such that a portion 140 of the tank volume protrudes from beneath the washing chamber 50 and is disposed directly below the pump 100. This feature enables the height of the tank to be reduced over that of the prior art, while maintaining the same tank volume. By reducing the tank volume, the height of the access opening can in turn be kept to a minimum, making it easier for users to manipulate parts into and out of the basket 20. In prior art cleaning apparatus, the pump is mounted at ground level and the tank does not project beyond the

washing chamber. Consequently, the tank height is greater and the access opening is located at an awkward height. In this embodiment, the fraction of the total tank volume which is disposed directly below the pump 100 is approximately 25%. However, it will be understood that the present invention includes embodiments in which this fraction is either more or less than 25%.

The side walls 30 of the basket are sufficiently high to support an elongate mechanical part in a vertical or semi-vertical orientation. An upper end 150 of the basket 20 is open to allow parts to be top-loaded into the basket. The lid 70 has an upper surface 160 and downwardly-depending side walls 170 which provide room for elongate parts to protrude above the basket 20 while being washed.

The base 40 of the basket includes a base hub 180 connected to a base outer rim 190 by eight base spokes 200. The base outer rim 190 is connected to a base hoop frame 210 by sixteen radially-oriented rotator blades 220 which extend downwardly from the base 40. Wire mesh covers the base 40 and extends along the side walls 30 between the base hoop frame 210 and a top hoop frame 230.

During cleaning, the basket 20 is rotated around its central axis in order to expose all of the parts to cleaning solution sprayed from the spray manifold 110. Basket rotation is driven by a jet of spray from an aperture 240 in the spray manifold 110 which impinges on the rotor blades 220. The basket 20 rotates on a drive shaft 250 protruding downwardly from the base 40 of the basket to a bearing assembly 260. The spray manifold 110, shown in detail in Fig 6, comprises a generally L-shaped tubular loop. The manifold has two vertical tubular portions 270 which extend from beneath the basket 20 to

above the basket, and two horizontal tubular portions 280 which extend beneath the base 40 of the basket. Spray holes 290 are formed on surfaces of the spray manifold 110 which face the basket 20. However, it will be understood by a person skilled in the art that the number, size, and distribution of spray holes in the spray manifold can be varied. The spray manifold 110 has an inlet 300 which is connected to the pump 100. The tank 90 has a sloped base 310 which urges the cleaning solution to drain towards a lower end where a suction pipe 320 is connected to an inlet 330 of the pump 100. The suction pipe 320 draws in cleaning solution through an in-line filter 340 to avoid recirculating particulate matter. The filter 340 comprises a metal cap with perforations which are approximately 100 μm in diameter. All cleaning solution which drains from the washing chamber 50 into the tank 90 is filtered with a strainer basket 350 designed to filter out larger particulate matter such as swarf. The pump 100 is powered by a single phase 240 volt electric motor, and the operation of the pump and any other electrical components is controlled by a digital processor housed within a control box 360. A control panel 370 on the control box 360 enables a user to control the digital processor (not shown). A micro switch assembly 380 located adjacent the control box 360 is arranged to detect whether the lid 70 is in an open or closed state, and to send this information to the digital processor. Cleaning operations are inhibited by the digital processor when the micro switch 380 senses that the lid 70 is open. Electrical power is supplied to the apparatus by connecting a power cable at an electrical terminal box 390.

The apparatus 10 is mounted on three swivelling castor wheels 400 in order to enable it to be readily moved by a user. Each wheel includes a locking mechanism (not shown) which can be used to selectively lock the wheels such that rolling is prevented. The apparatus also provides a manual cleaning mode. In this mode, a tube (not shown) is connected to the pump and parts contained within the basket can be manually washed by hosing them with a flow of cleaning solution supplied by the pump 100. As with the automatic mode described above, cleaning solution drains off the parts and collects in the tank 90, where it is recirculated by the pump 100 back through the hose. Any one of a variety of different attachments may be connected to the end of the hose to assist with cleaning, such as a jet nozzle, a spray nozzle, or a scrubbing brush. The pump 100 includes a switch (not shown) which diverts cleaning solution from the spray manifold to the hose, and vice versa.

It will be appreciated by a person skilled in the art that numerous variations and/or modifications may be made to the present invention as shown in the specific embodiments without departing from the spirit or scope of the invention as broadly described. The present embodiments are therefore to be considered in all respects to be illustrative and not restrictive.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A cleaning apparatus for automatically washing and degreasing mechanical parts, including industrial automotive parts, using a cleaning fluid, the apparatus comprising a top-loading washing chamber, a sprayer for spraying cleaning fluid over the parts, a pumping device for pumping cleaning fluid into the sprayer, and a collection tank for collecting cleaning fluid which drains off the parts, the collection tank forming a base of the apparatus beneath the washing chamber, and the apparatus being arranged to recirculate cleaning fluid by pumping at least some of the cleaning fluid collected in the tank back to the sprayer, wherein the tank is arranged such that a portion of the collection volume protrudes from beneath the washing chamber and at least some of the protruding portion is disposed vertically below the pumping device.

2. The cleaning apparatus according to claim 1 wherein the cleaning fluid is heated to a temperature of substantially 68 °C.

3. The cleaning apparatus according to any one of the preceding claims wherein the cleaning fluid has a pH in the range from 11 to 11.5.

4. The cleaning apparatus according to any one of the preceding claims wherein the cleaning fluid comprises an aqueous solution.

5. The cleaning apparatus according to any one of the preceding claims wherein the pumping device is powered by an electric single-phase motor.

6. The cleaning apparatus according to any one of the preceding claims wherein the apparatus includes a

holder arranged to hold elongate parts such that they are oriented vertically or semi-vertically during cleaning.

7. The cleaning apparatus according to claim 6 wherein the holder includes a removable vertical dividing wall arranged to form a plurality of compartments in the holder.

8. The cleaning apparatus according to either claim 6 or claim 7 wherein the holder is arranged to rotate during cleaning, the rotation being driven by a flow of cleaning fluid from the spraying means.

9. The cleaning apparatus according to claim 8 wherein the holder includes a rotor blade arranged to intercept the flow of cleaning fluid such that the holder is forced to rotate.

10. A cleaning apparatus substantially as hereinbefore described with reference to the accompanying drawings.

Dated this 11th day of 2001

ERS AUSTRALIA PTY LTD

By its Patent Attorneys

GRIFFITH HACK

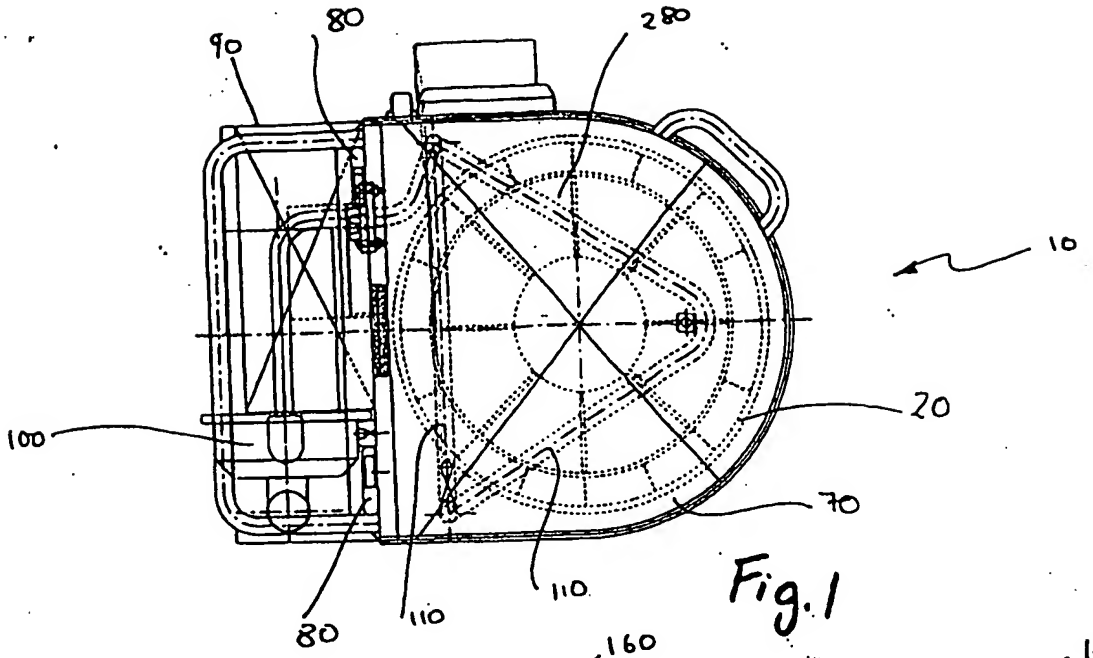
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Fig. 1

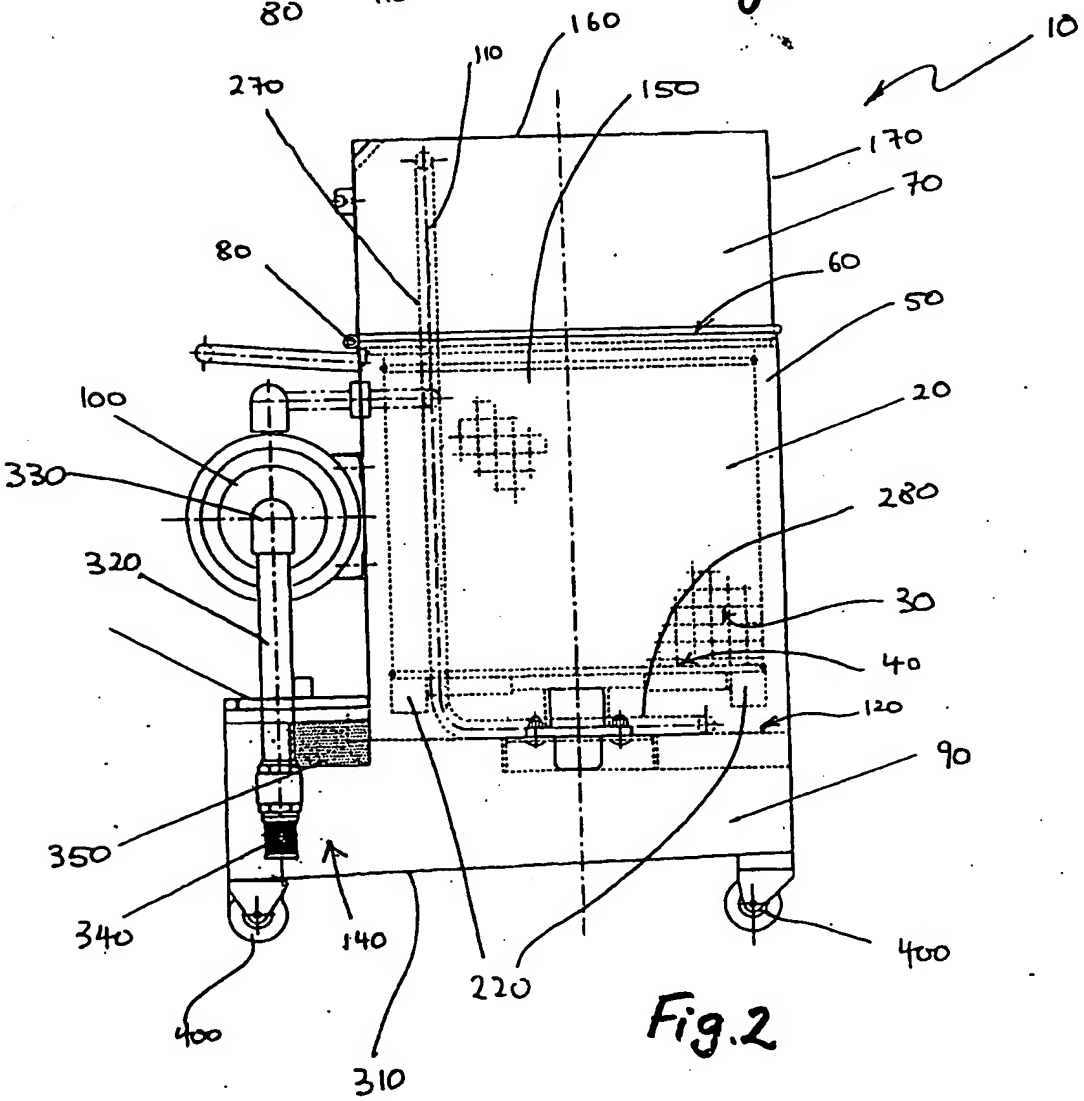
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Fig. 2

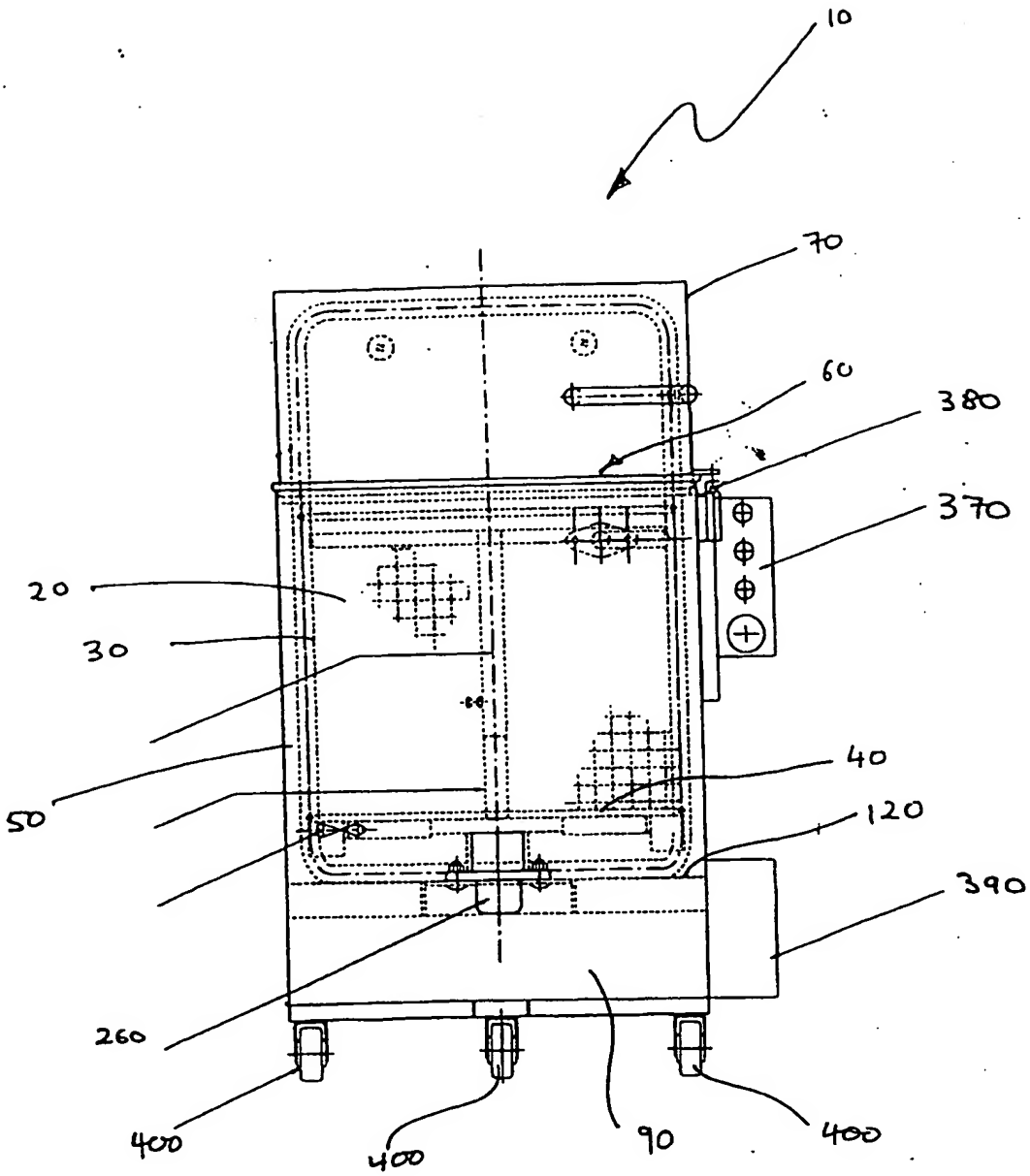
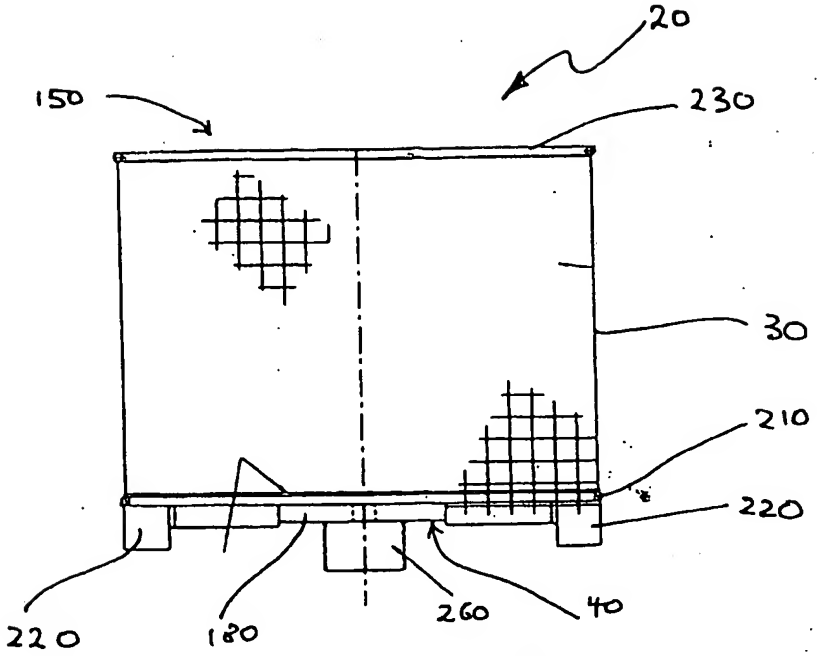



Fig. 3

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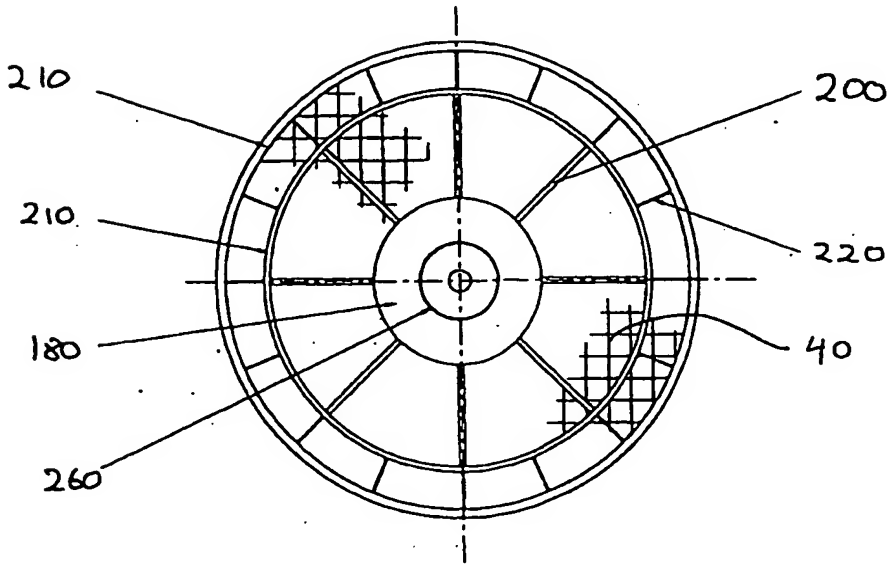


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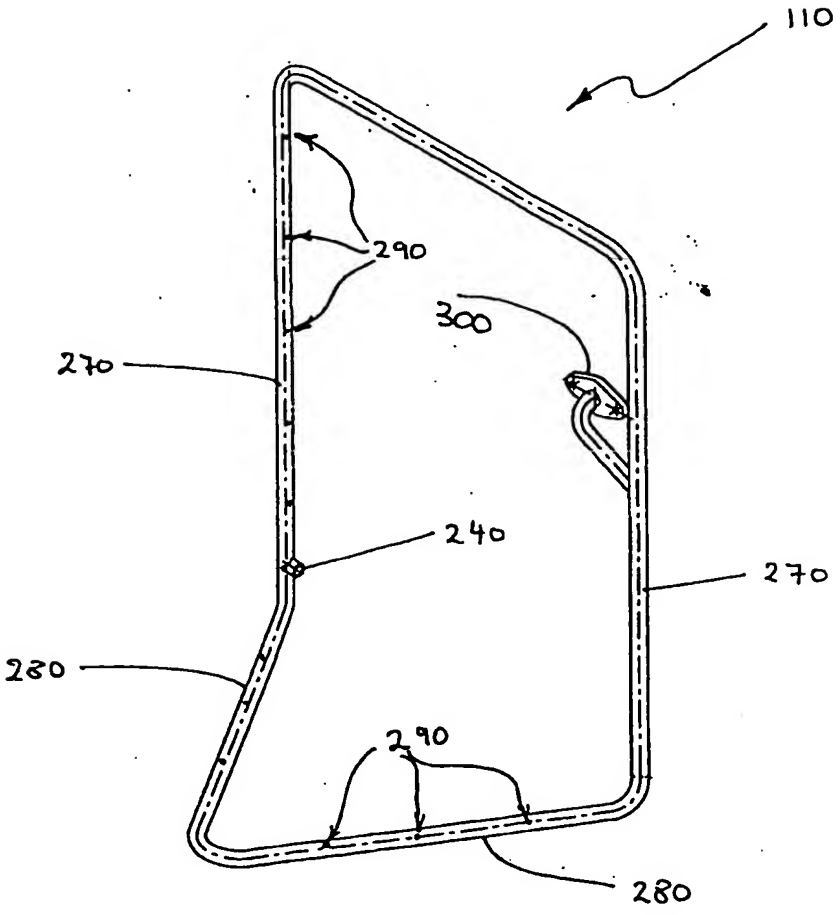


Fig. 6

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